

Extended distribution of *Cymbidium concinnum* (Orchidaceae) and its conservation status in India^a

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Abstract

Cymbidium concinnum Z.J.Lui & S.C.Chen (Orchidaceae) is reported as a new distributional record to India from Manipur. Its detailed description supplemented by photo-plates and information on habitat, phenology, anatomy and distribution is provided. An artificial identification key to all the taxa under the section *Eburnea* of the genus *Cymbidium* occurring in India is also provided. Its red list status is also discussed in the paper.

Résumé

Extension de la distribution géographique de *Cymbidium concinnum* (Orchidaceae) et statut de conservation du taxon en Inde – *Cymbidium concinnum* Z.J.Lui & S.C.Chen (Orchidaceae) est enregistré pour la première fois dans l'état de Manipur, Inde. Pour en faciliter l'identification, une description morphologique détaillée, accompagnée de photographies, en est proposée. Des informations sur l'habitat, la phénologie, l'anatomie et la distribution géographique sont données. En outre une clé artificielle d'identification des espèces de la section *Eburnea* observables en Inde est fournie. Le statut de conservation de l'espèce est également discutée.

Introduction

The genus *Cymbidium* O.Swartz comprises different epiphytic, lithophytic and terrestrial species. It has about 72 species, 10 varieties, 8 subspecies and 14 natural hybrids distributed all over the world: India, southeast Asia,

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China, Japan, Indonesia to Australia (Govaerts *et al.*, 2014). Out of which 26 species, 5 subspecies and 4 varieties are found in India (Misra, 2007). In Manipur 15 species were reported (Kumar & Kumar, 2005). During a field exploration by a team of Scientists of the Orchid Research and Development Centre, Hengbung, in Oklong area of Senapati District of Manipur during 2012, some interesting specimens of epiphytic orchids such as *Cymbidium cochleare* Lindley, *Oberonia teres* A.F.Kerr, *Oberonia ensiformis* (J.E.Smith) Lindley etc, have been collected and cultivated in the facilities at Hengbung as part of an *ex situ* conservation project. Upon further study and a literature review of some pertinent publications (Deva & Naithani, 1986; Chowdhery, 1998; Pearce & Cribb, 2002; Lui *et al.*, 2006; Lucksom, 2007; Chen *et al.*, 2009) and consultation of the images of type materials deposited in ARUN, ASSAM & CAL, one of these taxa has been identified as *Cymbidium concinnum* Z.J.Lui & S.C.Chen, a species hitherto known only from China. Hence the present collection of this species from Manipur in India forms an extended distribution further westwards into NE Himalayas.

A detailed description, together with photographs and data about phenology, habitat and distribution, is provided below for easy identification in the field. Taxonomy and anatomy of this species are also discussed and an artificial key to all the taxa of *Cymbidium* section *Eburnea* C.J.Seth & P.J.Cribb known to be present in India is also provided. The threat status of *Cymbidium concinnum* in India is assessed by applying IUCN Red List criteria and guidelines.

Material and methods

Anatomical observations. Thin cross sections from the middle portion of matured leaf of *Cymbidium concinnum* were obtained with a sharp razor blade and stained with safranin (Guan *et al.*, 2010). The sections were examined under a light microscope (Olympus CX31) at different magnifications. The adaxial and abaxial epidermis of matured leaves were peeled from fresh leaves for observation of stomatal type, density, wax secreting cells, etc. The area of stomatal apparatus was calculated by using the formula $\frac{1}{4} \times \pi \times l \times w$ (Guan *et al.*, 2010 – l = length, w = width) and the stomatal density was calculated as follows: Number of stomata/Number of grids \times area of 1 grid square. All sections were photographed, and the images were analysed using Adobe Photoshop.

Results and discussion

Cymbidium concinnum Z.J.Lui & S.C.Chen, *Acta Phytotaxonomica Sinica* 44: 179 (2006); Chen *et al.*, *Flora of China*, 25: 73. 2009. (Fig. 1)

Description. Epiphyte; pseudobulbs 4-7 × 1-2.5 cm, subovoid, bilaterally flattened, covered with sheathing leaf bases; leaves 8-14, 25-50 × 0.6-1.5 cm, jointed, linear-oblong, acute-acuminate, leathery; inflorescence 25-45 cm long, arising from the leaf axil, arcuate; peduncle with 2 to 3 sheaths, green, terete; rachis lax, 6-10 flowered; floral bracts 3-4 × 2.5 mm, triangular, green; flowers 5-7 cm across, widely opening, greenish brown with purple-red venation and many small spots; pedicel with ovary 1.5-2.2 cm long, green; dorsal sepal 4.0-4.5 × 0.9-1.1 cm, narrowly obovate-oblong, acute, concave, arched over the column; lateral sepals 3.8-4.3 × 0.9-1.1 cm, slightly oblique, acute; petals 3.8-4.3 × 0.8-1.0 cm, linear-oblong, acute, falcate; lip 3.0-3.5 × 2.0-2.2 cm, brownish yellow with purple-red venation, elliptic-obovate, fused at base to basal margins of column for c. 3 mm, with 2 lamellae on the disc extending from the base of the lip to the base of the midlobe, which are hairy and convergent, 3-lobed; lateral lobes acute, erect, clasping column; midlobe 7-10 × 8-10 mm, broadly ovate, undulate at margins, blotched with purple-red; column 2.4-3.0 cm long, narrowly winged towards apex, yellowish green with purple-red linings, slightly curved; anther cap 2.5-3.5 × 2.0-2.6 mm, 2-chambered, minutely papillose, yellow; pollinia 4, in two unequal pairs, triangular, orange yellow.

Flowering. November-December.

Habitat. Epiphytic. Found growing in semi shaded areas in temperate forest in association with *Cymbidium cochleare*, *Oberonia teres*, *Oberonia ensiformis*, etc.

Distribution. INDIA: Manipur; CHINA: Lushui.

Specimens examined. India: Manipur, Senapati district, Oklong, 1611 m, 25°23.381' N, 94°00.236' E, collection no. Chowlu 1652, flowering 16.11.2014 (spirit preserved flower material deposited in the herbarium of Centre for Orchid Gene Conservation [COGCEHR], Hengbung); limited number of live plants are under cultivation in the orchidarium of the Centre for further multiplication through micropropagation as part of an *ex situ* conservation project. China: Yunnan. Lushui, Pianma, 2300m, [holotype of *Cymbidium concinnum*: 2918 (SZWN)].

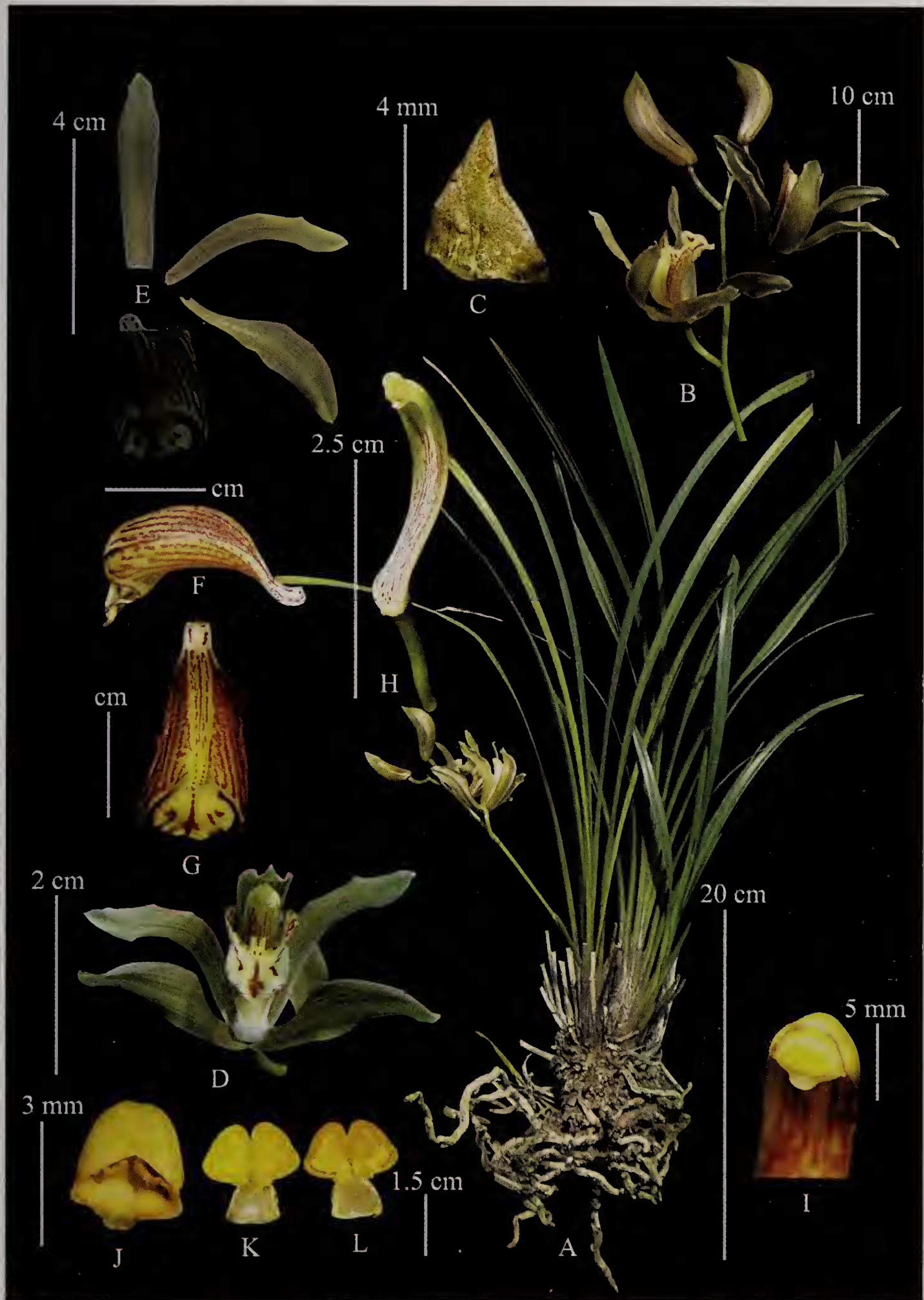


Fig. 1: *Cymbidium concinnum* Z. J. Lui & S. C. Chen

A. Habit; B. Inflorescence; C. Bract; D. Flowers; E. Dissected parts; F. Lip (side view); G. Lip (dorsal view); H. Column with pedicel ovary; I. Column tip with pollinia; J. Anther cap; K. Pollinia (dorsal view); L. Pollinia (ventral view). [Chowlu 1652; photographs by Chowlu]

Note. While going through the description in the protologue it has been noted that the plants from Manipur (India) have scattered red blotches on the midlobe of the lip whereas the analogous spots on the Chinese plants are arranged in a V-shape pattern. Furthermore, it was observed that the the peduncle of inflorescence of the Malipur plants has only 2 to 3 sheaths whereas the peduncles of specimens from China show many more sheaths. However, such differences can be seen as natural variations due to the different climatic conditions at the habitats.

Anatomical observations

The cuticle of the adaxial surface is found to be thicker than the cuticle on the abaxial surface. The presence of thick cuticles on the leaf surface is an indicator of aridity (Haworth & McElwain, 2008). Both adaxial and abaxial surfaces have rectangular to polygonal epidermal cells. Adaxial epidermal cells are thicker than abaxial ones. Mesophyll cells are not differentiated into palisade and spongy cells. Middle (between adaxial and abaxial surfaces) vascular bundles are almost globular and larger than adaxial and abaxial ones. The stomata are observed only on the lower surface (hypostomatic) and proved to be of the paracytic type. The guard cells are sub-orbicular to orbicular. Stomatal distribution, size, density, morphology and behaviour are closely associated with plant transpiration. Wax secreting cells plays a double part in protecting the leaves: they form a sunscreen and aid in shedding rain so that the leaf cells do not become overly saturated with water and burst (Ferry, 2008). Table 1 and Fig. 2.

Table 1. Leaf anatomical traits of *Cymbidium concinnum*

LT (μm)	Ct _{ad} (μm)	CT _{ab} (μm)	ET _{ad} (μm)	ET _{ab} (μm)	MT (μm)	VBML (μm) (middle)	VBMW (μm) (middle)	<i>d</i> (mm^{-2})	A _s (μm^2)
262.23 ±6.8	12.1 ±0.6	11.1 ±0.5	31.9 ±2.6	26.1 ± 1.6	210.0 ± 3.7	172.8 ±6.0	165.7 ±4.0	19.34 ±0.39	607.9 ± 23.2

LT. leaf thickness, Ct_{ad}. adaxial cuticle thickness, CT_{ab}. abaxial cuticle thickness, ET_{ad}. adaxial epidermis thickness, ET_{ab}. abaxial epidermis thickness, MT. mesophyll thickness, VBML. length of middle vascular bundle, VBMW. width of middle vascular bundle, *d*. stomatal density, A_s. stomatal apparatus area. (Mean ± SEM)

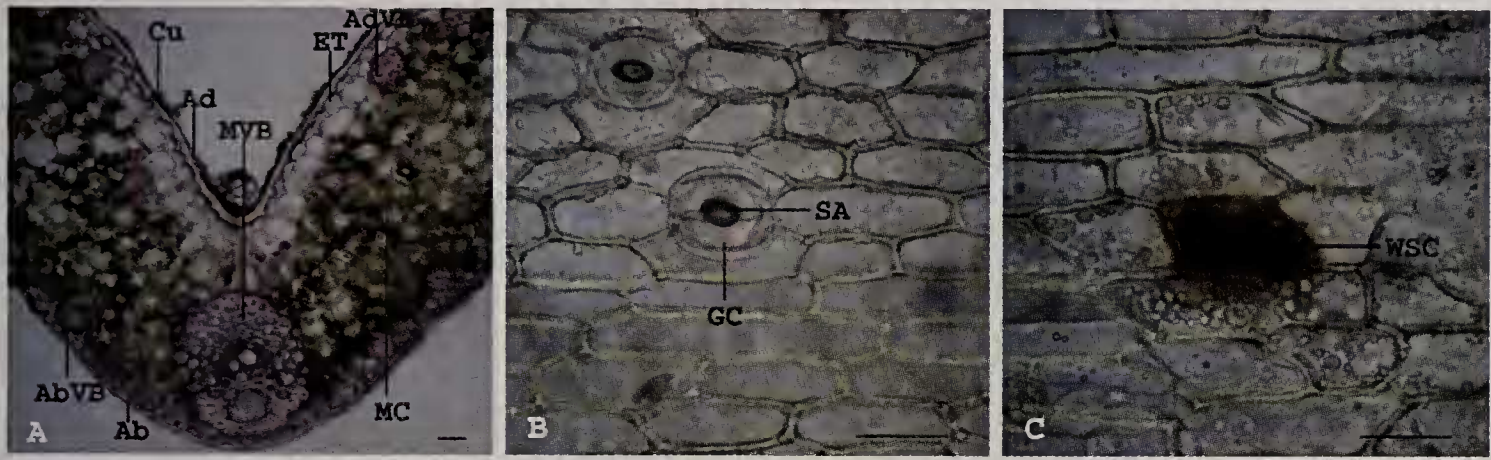


Fig. 2 : *Cymbidium concinnum*: leaf anatomical traits

A. Cross section of leaf; B. Paracytic type of stomata; C. Wax secreting cells

Ab abaxial, Ad adaxial, AbVB abaxial vascular bundle, AdVB Adaxial vascular bundle, Cu cuticle, ET epidermal tissue, MC mesophyll cells, MVB middle vascular bundle.

SA Stomatal apparatus, GC Guard cell, WSC Wax secreting cell

Scale bars, 30µm. Photographs under light microscope by Bishwajit.

Conservation status in India. *Cymbidium concinnum*, hitherto considered endemic for China, is now also known from a single locality in northeastern India: Oklong, Senapati, Manipur. Our diligent survey has yielded only a total of 5 mature individuals spread over an area of 1 km² of semi shaded forest patch which is a community forest under the management of local people. The habitat is subjected to high degree of human encroachment for agricultural practice. The 'Jhum' cultivation practice by the local tribal people which involves tree cutting, burning and clearance of the forest poses a serious threat to the natural habitat (Fig. 3) of the present species as well as its natural pollinators. This epiphytic species propagates vegetatively by annual sympodial growth from the base of the pseudobulbs which is very slow. Climate change is one of the major threats for this species. Being an epiphyte, its regeneration is very slow i.e. more than 1 year. As there is no data available regarding the rate of population reduction, Criteria A and C (IUCN, 2012) cannot be applied to evaluate its threat status. As it is (as we have stated above) known from a single locality of 1 km² area, its Extent of Occurrence (ECO) and Area of Occupancy (AOO) are equal and estimated 2 to 3 km² (Criteria B1, B2) by considering the grid of maximum size i.e. 1 km × 1 km. Because the population size in Manipur is very small (Criteria D), the species is assessed as "Critically Endangered".

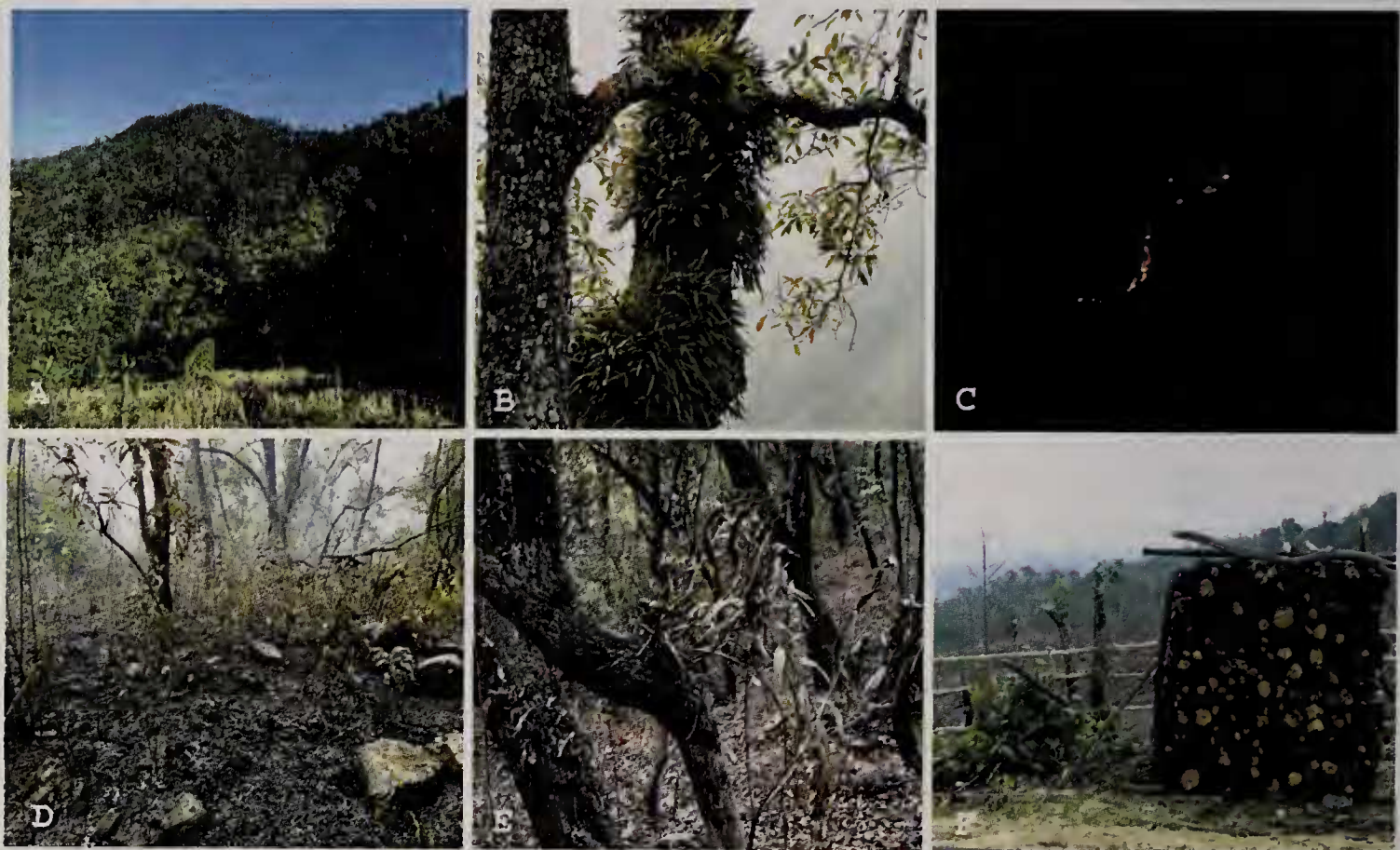


Fig. 3: Natural forest destruction at Oklong (Manipur) surroundings

A. Forest cover during 2010; B. A tree with many epiphytic orchids; C. Forest fire seen from distance at night during 2012; D. Portion of the forest burnt for 'Jhum' cultivation by local people; E. Epiphytic orchids burnt due to fire; F. Felling of forest trees for firewood.

Photographs by Bishwajit

Key to the species of *Cymbidium* section *Eburnea* in India

(after Chen *et al*, 2009)

- 1a. Inflorescence pendulous2
- 1b. Inflorescence not pendulous4
- 2a. Flowers not pendulous, opening widely*C. concinnum*
- 2b. Flowers pendulous, not opening widely3
- 3a. Flowers creamy-yellow to pale yellow-green*C. elegans*
- 3b. Flowers tawny brown*C. cochleare*
- 4a. Pseudobulb stemlike, continuously elongating*C. mastersii*
- 4b. Pseudobulbs not stemlike, nor continuously elongating*C. eburneum*

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